REMARKS

Applicants appreciate the thorough examination of the present application as evidenced by the Final Office Action mailed July 29, 2009 (hereinafter "Final Action"). In response, Applicants respectfully submit that the cited references do not disclose or suggest, at least, the recitations of independent Claim 1. Accordingly, Applicants respectfully submit that all pending claims are in condition for allowance. Favorable reconsideration of all pending claims is respectfully requested for at least the reasons discussed hereafter.

Independent Claim is Patentable

Independent Claim 1 stands rejected under 35 U.S.C. §103(a) as being unpatentable over U. S. Patent No. 5,378,325 to Dastolfo, Jr. et al. (hereinafter "Dastolfo") in view of U. S. Patent No. 6,540,902 to Redey et al. (hereinafter "Redey") (Final Action, page 2). Independent Claim 1 is directed to an apparatus and recites, in part:

> a container having spent nuclear fuel therein;
> an electrochemical cell in the container which comprises:
> a body or housing;
> a cathode container; and
> a cathode connector;
> wherein said body or housing is maintained as the cathode, and said electrochemical cell is free from bolted or screwed fittings; and
> wherein said body or housing is configured to connect with the spent nuclear fuel so as to reduce to metallic form undissolved metal oxides contained in the spent nuclear fuel, which are responsive to a voltage applied thereto.

According to independent Claim 1, as amended, a container has spent nuclear fuel therein along with an electrochemical cell. The electrochemical cell comprises a body or housing that is maintained as a cathode and is configured to connect with the spent nuclear fuel to facilitate reduction of metal oxides contained in the spent nuclear fuel to metallic form, which are responsive to a voltage applied thereto. Such embodiments are described in detail in the paragraphs 14 through 16 of the published application, which state:

> In operation, the body or housing of the cell is maintained as the cathode, and said cathode is brought into contact with the cathode container

> by means of the cathode connector. Thus, contact is made between the cathode container and the cathode connector in order to facilitate the electrolytic process. Contact may be most conveniently achieved by means of a simple press connection between the two components.
>
> The cathode container preferably comprises a basket, such as a mesh basket, or vessel, typically a metal oxide retaining vessel, and – most preferably – comprises an assembly of such baskets or vessels. In order to effect electrical connection between such an assembly of cathode containers and the cell body during operation of the cell, it is necessary to provide a multiplicity of connectors and to effect contact between individual cathode baskets or vessels and individual connectors, preferably by means of a multiplicity of press connections.
>
> Preferably the oxide is in contact with the cathode container and it is preferred that the cathode is in the form of a mesh basket or, most preferably, an assembly of mesh baskets, with the oxide being contained within the said baskets. In this case, contact between the assembly of cathode containers and the cathode connectors is most simply achieved when the cathode connectors are in the form of a multiplicity of cathode rails which are welded to the base of the cell, allowing press contact to be brought about by the weight of the oxide feedstock in the cathode basket. This represents the most preferred embodiment of the first aspect of the invention.

Thus, independent Claim 1 recites an apparatus for the production of metals by the electrolysis of the corresponding metal oxides wherein the oxide to be reduced is **not** dissolved in the molten salt electrolyte, but remains as a solid, located in the cathode container, which is maintained in contact with the molten salt phase because electrons need to be delivered to this captive metal oxide. However, the cathode container in which the oxide is located is not an integral part of the electrolysis unit because, as stated above, "[i]n order to effect electrical connection between such an assembly of cathode containers and the cell body during operation of the cell, it is necessary to provide a multiplicity of connectors and to effect contact between individual cathode baskets or vessels and individual connectors, preferably by means of a multiplicity of press connections."

Applicant respectfully submits that this is a completely different arrangement to those found in the apparatus provided by Dastolfo and Redey. Dastolfo teaches a low temperature salt bath for the electrolysis of metal oxides to produce the corresponding metal, wherein the bath comprises an electrolyte containing at least one fluoride salt and at least one chloride

salt, the fluoride salt being present to increase the metal oxide solubility in the molten salt bath. Thus, it is clear that this is a quite different type of apparatus, wherein it is required that the metal oxide is dissolved in the electrolyte. Thus there is no suggestion by Dastolfo *et al* of an arrangement such as that provided

Specifically, Dastolfo describes the operation of an aluminum electrolysis cell wherein the behavior and operation of the cathode is unique to liquid metal cathodes. In the illustrated systems, Figure 1 shows the cathode to be (liquid) aluminum metal while, in Figure 2, the cathode is both the carbon lining and the liquid aluminum. In both cases, however, the production of aluminum is reliant upon the supply of electricity (electrons) to the liquid salt phase wherein reduction of the dissolved aluminum oxide to the metal takes place. Clearly, this is a quite different arrangement to that of the present invention, wherein the oxide is not dissolved in the electrolyte, but is located in the cathode container in solid form and is required to be maintained in contact with the electrolyte. Thus, Dastolfo is concerned with an electrowinning process, which involves dissolution of species in an electrolyte (e.g. molten salt), followed by recovery of the metal at a cathode, whereas the present invention is directed towards an apparatus for carrying out direct reduction, which requires reduction of the oxide phase at a cathode without dissolution.

Furthermore, it is noted that conventional wisdom when trying to carry or transport electrical current or electrons through solids, for example metal wire, whether in a situation such as a lighting circuit in a building, or with electrical connections to an electrochemical system like a car battery, would be to adopt an arrangement using either screwed or bolted connections and, for the electrochemical system of the present invention, it would be reasonable to expect a skilled person to adopt such a conventional approach. However, embodiments according to the present invention do not use this approach but, instead, use a cathode container that may be electrically connected, such as by force of gravity, via a "push connection" to a cathode rail, which is immersed in the electrolyte and located at the base of the electrolysis unit. This is a unique approach that is not in any way taught or suggested by Dastolfo, which includes no disclosure of a means of connection of the oxide in the cathode container, via a cathode connector, to the body of the cell, which serves as the cathode.

The secondary reference cited by the Examiner does not appear to cure this deficiency. Redey is concerned with a method of controlling the direct electrolytic reduction of a metal oxide or mixtures of metal oxides to the corresponding metal or metals. The method uses a non-consumable anode and a cathode and a salt electrolyte with a first reference electrode near the non-consumable anode and a second reference electrode near the cathode. In operation, the anode potential is compared to the first reference electrode to prevent anode dissolution and gas evolution other than oxygen and the cathode potential is compared to the second reference electrode to prevent production of reductant metal from ions in the electrolyte. However, the Redey's method appears to utilize an entirely conventional electrochemical cell arrangement, with no suggestion whatsoever of the cathode connector arrangement recited in independent Claim 1.

For at least the foregoing reasons, Applicants respectfully submit that independent Claim 1 is patentable over Dastolfo and that dependent Claims 2 - 12 are patentable at least by virtue of their depending from an allowable claim.

Dependent Claims Are Patentable

As each of the dependent claims depends from a base claim that is believed to be in condition for allowance, Applicants do not believe that it is necessary to argue the allowability of each dependent claim individually. Applicants do not necessarily concur with the interpretation of these claims, or with the bases for rejection set forth in the Final Action. Applicants therefore reserve the right to address the patentability of these claims individually as necessary in the future.

CONCLUSION

In light of the above amendment and remarks, Applicants respectfully submits that the above-entitled application is now in condition for allowance. Favorable reconsideration of this application, as amended, is respectfully requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (919) 854-1400.

Respectfully submitted,

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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on December 29, 2009.

Kirsten S Carlos